Interfacial Surface Energy and Viscosity of Succinonitrile and Succinonitrile - Acetone Alloys at Various Temperatures using a Surface Light Scattering Spectrometer

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Succinonitrile (SCN) is useful as a model for the study of metal solidification; although it is an organic material, it has a BCC crystal structure and solidifies dendriticly like a metal. It is also transparent and has a low melting point (58.08 ºC). Thus succinonitrile has been and is being used extensively in materials science and fluid physics research such as several theoretical and numerical studies of dendritic growth. Interfacial free energies between the phases enters into many analysis of phase transformation and flow, including nucleation, dendritic growth, interface stability, Ostwald ripening, and Marangoni flow. Succinonitrile is a well established model material with several essential physical properties accurately known - except the liquid/vapor surface tension at different elevated temperatures. The dependence of surface tension on concentration and temperature is needed if Acetone-doped SCN is going to be used as a model material to study the effect of Marangoni convection generated by voids and/or bubbles on segregation patterns during microgravity solidification experiments of dilute alloys. Previous measurements of SCN surface tensions are extremely limited. Moreover, viscosity of SCN-Acetone alloys at elevated temperatures is also unavailable. We are presenting data of liquid-vapor interfacial surface energies and viscosity of succinonitrile (SCN) and SCN-Acetone alloys measured by a non invasive technique using Surface Light Scattering (SLS) spectroscopy. The accuracy of interfacial energy values obtained from this technique is better than 1 % and viscosity about 10 %. The results will be compared with the previous limited data measured only at the melt temperature obtained from other techniques. The Liquid/vapor interfacial energy measurements were made near the melting point and up to about 110 ºC for pure SCN and alloys of 0.6, 1.2, 2.4 and 5 % of acetone. We believe that our measurements have provided much needed basic physical property data of hi-fidelity in support of important research areas in microgravity and ground-based materials processing.